

contact, or complete osculation, with the given cubic. It is shown that the points in question are those which are their own third tangentials, and this suggests the consideration of the new canonical form, $x^2y + y^2z + z^2x + 2mxyz = 0$, of the equation of the cubic; this inquiry, however, is not pursued in the paper.

XX. "Researches on the Foraminifera."—Part III. On the Genera *Peneroplis*, *Operculina*, and *Amphistegina*. By W. B. CARPENTER, M.D., F.R.S. &c. Received June 17, 1858.

(Abstract.)

In his preceding memoirs, the author has shown that two very dissimilar types of structure present themselves among Foraminifera, one characterized by its simplicity, the other by its complexity. In the former, of which *Orbitolites*, *Orbiculina*, and *Alveolina* are typical examples, the calcareous skeleton does not present any definite indications of organization, but seems to have been formed by the simple calcification of a portion of the homogeneous sarcode-body of the animal; that sarcode-body is but very imperfectly divided into segments, the communications between the cavities occupied by these segments being very free and irregular; the form of the segments themselves, and the mode of their connexion, are alike inconstant; and even the plan of growth, on which the character of the organism as a whole depends, though preserving a general uniformity, is by no means invariably maintained. In the latter, to which *Cycloclypeus* and *Heterostegina* belong, the calcareous skeleton is found to present a very definite and elaborate organization. The several segments of the body are so completely separated from each other, that they remain connected only by delicate threads of sarcode. Each segment thus isolated has its own proper calcareous envelope, which seems to be moulded (as it were) upon it; and this envelope or shell is perforated with minute parallel tubuli closely resembling those of dentine, except in the absence of bifurcation; the partition-walls between adjacent segments are consequently double, and are strengthened by an intermediate calcareous deposit, which is traversed by a system of inosculating passages that seems properly to belong to it. The form of the segments, their mode of

communication, and consequently the general plan of growth, have a very considerable degree of constancy; and altogether the tendency is strongly manifested in this type to the greater individualization of the parts of the composite body, which in the preceding must be looked upon rather as constituting one aggregate whole.

In the present memoir this contrast is fully carried out by a detailed comparison of two characteristic examples from these types respectively, each of them having its own features of peculiar interest.

In *Peneroplis* we find, both as to the simplicity of the structure of the shell, and the general disposition of the segments of the animal, a close resemblance to the spiral forms of *Orbiculina*; the only difference being the absence of the transverse or secondary divisions of the chambers. In what is considered its typical form, the shell is a flattened spire, opening out widely in its last whorl; and the chambers communicate with each other (as does the last chamber with the exterior) by single rows of isolated pores disposed at regular intervals along the septa. But the spire is occasionally found to be more turgid, and the rows of apertures to become doubled; and instead of opening out in the last whorl, it is frequently prolonged in a rectilineal direction. In tropical seas there are found minute shells resembling those of *Peneroplis* in their very characteristic external markings, but having a very turgid spire, and having the row of pores in each septum replaced by a single large orifice with irregularly radiating prolongations. This type of structure has been characterized by M. d'Orbigny as a separate genus, under the name of *Dendritina*; and when its spire, as in many forms of *Peneroplis*, is continued rectilineally, it has been distinguished as a third genus under the name *Spirolina*. The author shows, by an extensive comparison of individuals, that the single dendritic orifice is to be regarded as formed by the coalescence of separate pores; and that the extension of these into a single line, or their aggregation into a cluster, is related to the form of the septal plane, as determined by the degree of flattening or of turgescence of the spire. Consequently in his view *Dendritina* and *Spirolina* are but varieties of *Peneroplis*; the former, which are by far the largest and the most highly developed, being of tropical growth, whilst the most flattened forms of the latter are the com-

paratively stunted inhabitants of the Mediterranean and other seas of less elevated temperature.

In *Operculina*, on the other hand, we find the shell presenting the minutely tubular structure which was first shown by the author to exist in *Nummulites*; to which genus *Operculina* is so closely allied in structure, that the only positive difference between them seems to lie in the tendency of *Operculina* to open out widely in the last whorl, whilst *Nummulites* (according to MM. d'Archiac and Haime) tends to close in. The author minutely describes the structure of *Operculina*, which presents a very remarkable development of the canaliferous system; he also enters into a detailed inquiry into the relation of the numerous strongly-marked varieties of form which it presents,—a question of much importance in regard to the value of the characters of the reputed species among *Nummulites*; and shows that the range of individual variation in form and surface-markings is so wide (as is proved by the gradational transitions which present themselves between what at first sight appear to be widely-separated types), that only where some very decided and constant difference of internal conformation presents itself, will it be safe to assume a specific diversity. In one case, in which he had thought that a certain series of specimens was sufficiently distinguished by its peculiar physiognomy from the rest, residual forms presented themselves which could not be with certainty assigned to either type, so completely do they link together the two by the softening down of the peculiarities of each. And a yet more remarkable link of connexion is established by examples collected on the coast of Japan by the American expedition to that country, in which the most distinctive characters of each type are curiously combined.

Closely related to *Operculina* is another genus, *Amphistegina*, which bears an equally near resemblance to *Nummulites*, though it has been completely separated from both in the classification of M. d'Orbigny, who has placed it in a distinct order, *Entomostègues*, on account of the unsymmetrical form of its shell and the alternating disposition of its chambers. But the author has found, from an extensive comparison of individuals, that this want of symmetry is so little constant, as to be altogether valueless in a systematic point of view, many specimens being perfectly symmetrical, whilst others are very far from being so, and every gradation presenting itself

between these two extremes. The most common among existing species is the *Amphistegina gibbosa*, which is very extensively diffused through the tropical ocean, and which, though generally of small size, acquires in the Philippine region dimensions nearly equal to those of the fossil *Amphistegina* of the Vienna and other tertiary deposits. But Mr. Cuming's Philippine collection contains another and far larger species, which is distinguished by the extraordinary thinning-out of the last whorl; and it is remarkable that in this species the canal-system is highly developed, although completely absent in *A. gibbosa*,—a difference of structure, which, going along with very close resemblance in external aspect and general conformation, seems only to be accounted for on the supposition that the difference in size requires a difference in the arrangement of the nutrient apparatus.

XXI. "Further Researches on the Grey Substance of the Spinal Cord." By J. LOCKHART CLARKE, Esq., F.R.S.
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(Abstract.)

In this communication it is proposed, for reasons assigned, to divide each lateral half of the posterior grey substance into two portions :—1. The *caput cornûs posterioris*; 2, the *cervix cornûs posterioris*. The *caput* consists of the broad or expanded extremity of the cornu, and is separated from the *cervix* by an imaginary line drawn across from the opposite anterior extremities of the gelatinous substance; the *cervix* comprises the remaining anterior portion of the cornu.

The *caput cornûs* consists of two different portions :—1. an outer and comparatively transparent portion, the *gelatinous substance*; 2. an inner and more opaque portion, or base.

1. The outer portion or gelatinous substance consists of,—

A. Nerve-fibres, transverse, longitudinal, and oblique.

B. Nerve-cells, large, small, and intermediate.

C. Blood-vessels, and connective tissue, with numerous nuclei.

2. The inner or more opaque portion of the *caput cornûs* is continuous with the grey substance of the *cervix*, and surrounded